Topical (pour-on) ivermectin in the treatment of canine scabies

Manon Paradis, Caroline de Jaham, Nadia Pagé

Abstract — The efficacy of a pour-on formulation of ivermectin at 500 µg/kg body weight applied on the dorsum on days 1 and 15 was evaluated in 90 dogs from a shelter, naturally infested with *Sarcoptes scabiei*. This very practical form of treatment was successful in eradicating scabies from this shelter.

Résumé — Efficacité de l'ivermectin, solution à verser, dans le traitement de la gale sarcoptique canine. L'efficacité de l'ivermectin, solution à verser, appliqué sur le dos aux jours 1 et 15 à la dose de 500 µg/kg de poids corporel a été évalué chez 90 chiens d'un refuge naturellement infecté par *Sarcoptes scabiei*. Ce traitement très pratique a permis l'éradication du parasite de ce refuge.

(Traduit par docteur André Blouin)

Can Vet J 1997; 38: 379–382

Canine scabies is a nonseasonal, intensely pruritic, highly contagious, cutaneous infestation caused by the mite *Sarcoptes scabiei* var *canis*. Approved treatment by means of acaricidal dips (lime sulfur, amitraz) is often a tedious task, particularly when large numbers of animals are involved (1–3). The extra-label use of ivermectin, administered either SC or PO, has tremendously facilitated the clinical management of this condition (4–6).

In 1990, a topical ivermectin formulation became commercially available for eradicating endo- and ectoparasites in cattle. This 0.5%, alcohol-based, pour-on formulation of ivermectin (Ivomec pour-on for cattle, Merck AGVET, Pointe-Claire, Québec), administered at a dose of 500 µg/kg body weight (BW), appears equivalent in efficacy and identical in cost to the 1% injectable ivermectin solution (Ivomec for cattle, sheep and swine, Merck AGVET), administered at a dose of 200 µg/kg BW, SC, but the former is a much more practical form of therapy in that species. This cutaneous formulation has an approved claim for *Chorioptes bovis* and *Sarcoptes scabiei* var *bovis*, and for the control of the horn-fly, *Haematobia irritans*, for a period of 5 wk after application (7–9).

The purpose of this clinical study was to evaluate the efficacy of a topical formulation of ivermectin in the treatment of canine scabies.

Ninety dogs of an initial population of 120 dogs presumably naturally infested with *S. scabiei* participated in this trial. With the exception of a boxer and an Old English sheepdog, all dogs were mixed-breeds with several of German shepherd and retriever lineage. They consisted of 67 males and 53 females, approximately 70% of which had been neutered. Age ranged from approximately 3 mo to 10 y, with a mean age of 2 y. Mean body weight was 25 kg.

Département de sciences cliniques, Faculté de médecine vétérinaire, Université de Montréal, CP 5000, Saint-Hyacinthe (Québec) J2S 7C6.

The clinical signs of canine sarcoptic mange varied among dogs and were estimated to be severe in 15 dogs, moderate in 70 dogs, and mild in 35 dogs. The clinical signs varied from i) intense pruritus and diffuse alopecia, papules, crusting, excoriation, and erythema to ii) moderate pruritus and erythematous papular dermatitis confined to the pinnae, elbows, tarsus, and ventral portion of the thorax, to iii) mild pruritus with minimal or no skin lesions. Apparently, the excessive pruritus had started insidiously in a few dogs approximately 3 mo previously and was getting progressively worse; it affected the vast majority of the dogs at the time of our initial visit. All dogs appeared otherwise healthy on physical examination, with the exception of one German shepherd cross with relatively mild facial skin lesions, compatible with an autoimmune skin disease (either discoid lupus erythematosus or pemphigus erythematosus).

The dogs were confined in a shelter that was divided into 35 pens containing from 2 to 5 dogs/pen, based on social and behavioral compatibility. Twice a day, dogs were let free in the same fenced yard in groups of 30 to 50 dogs, so all dogs had possible contact with each other. In addition, approximately 4 new dogs entered the facilities and 4 dogs left the facilities each week of the study. Since the majority of the new dogs were puppies, they were more likely to be adopted than the "older residents" of the shelter, hence 90 of the 120 dogs present on day 1 of the trial were still at the shelter at the end of the study (day 150). Because it was impossible to avoid the introduction of new dogs into the shelter or likewise the departure of dogs, or to confine the new dogs in an isolated area, all dogs entering or departing the shelter during the trial were treated with 1% injectable ivermectin at the dose of 300 µg/kg BW, administered SC, and the treatment was repeated 2 wk later.

The pens had concrete floors that were cleaned daily with warm water. No acaricidal products were applied in the environment during the 150 d of the trial. During the study, all dogs were fed dry commercial dog food and water, free choice. Additional systemic or topical medications, other than the 1 reported here were not administered during the trial.

Table 1. Various commercially available ivermectin formulations

Route of administration	Species	Ivermectin concentration	Formulation	Dose rate (as labelled)
Subcutaneous[a]	Bovine, Ovine, Porcine	1% w/v	Nonaqueous solution	200 µg/kg 200 µg/kg 300 µg/kg
Oral drench[b]	Ovine Caprine	0.08% w/v	Propylene glycol base	200 µg/kg
Topical (pour-on)[c]	Bovine	0.5% w/v	Isopropyl alcohol	500 µg/kg
Oral solution[d]	Equine	1% w/v	Aqueous micellar solution	200 µg/kg
Oral paste[e]	Equine	1.87% w/v	Propylene glycol base	200 µg/kg
Oral tablets or chewable[f]	Canine	68, 136, or 272 µg/tablet	Beef base (in the chewable)	6 µg/kg
Oral chewable[g]	Canine	68, 136, or 272 µg/tablet	Beef base (combined with pyrantel pamoate)	6 µg/kg
Oral tablets[h]	Human	6 mg/tablet	—	150 µg/kg

[a]Ivomec for cattle and sheep and swine (Merck AGVET, Pointe Claire, Québec)
[b]Ivomec oral drench for goat and sheep (Merck AGVET)
[c]Ivomec pour-on for cattle (Merck AGVET)
[d]Eqvalan oral solution for horses (Merck AGVET)
[e]Eqvalan oral paste for horses (Merck AGVET) (Avoid using in small animals, because precise dosing is difficult)
[f]Heartgard-30 tablets or chewable (Merck AGVET)
[g]Heartgard-30 Plus chewable (Merck AGVET)
[h]Mectizan (Merck Frosst, Whitehouse Station, New Jersey, USA) (Donated to the 3rd world countries for human onchocercosis)

All 120 dogs were treated on day 1 and on day 15 with the alcohol-based, 0.5% topical (pour-on) formulation of ivermectin at a dose of 500 µg/kg BW (0.1 mL/kg). This was applied along the dorsal midline in a narrow strip in areas where no crusts or active mange lesions were present. The owner of the shelter was aware of the experimental nature of the treatment and possible adverse reaction in some dogs, and signed a release form.

On days 1, 15, 30, and 150, all dogs were evaluated clinically to establish the severity of clinical lesions. On day 1, 30 skin scrapings were taken from 3 severely affected dogs. One adult *S. scabiei* mite and 4 eggs were found. This was sufficient to confirm the etiology of the epidemic pruritic skin problem in this group of dogs. Because of the notorious difficulty in finding *S. scabiei* mites and eggs on skin scrapings, scrapings were not taken on subsequent rechecks. Instead, resolution of pruritus and skin lesions was used to monitor the efficacy of the treatment.

On days 1, 15, 30, and 150, approximately 20 stool samples were collected at random from different pens to perform fecal flotations to look for scabies mites or eggs, and to assess the degree of endoparasite infestation in the shelter, before and during the trial with pour-on ivermectin.

On day 15, a substantial clinical improvment was noted in all dogs, based on a marked decrease in the overall degree of pruritus and skin lesions. According to the dogs' caretakers, a marked decrease in pruritus was already noticed in all dogs approximately 7 to 10 d after the administration of the 1st treatment.

At day 30, clinical remission was observed in all but 2 dogs, as assessed by a lack of pruritus, evidence of hair growth, and a lack of erythema and crusting of the skin. The 2 affected dogs had skin lesions compatible with superficial pyoderma, and showed complete healing following administration of cephalexin (Novo-Lexin, Novopharm, Scarborough, Ontario) 30 mg/kg BW, PO, q12h for 3 wk.

At day 150, there were no clinical signs of scabies in any of the 90 dogs that were living at the shelter on day 1.

No *S. scabiei* mites or eggs were found on fecal flotations. Ascarids were found in 50%, 8%, 6%, and 8% of the stool samples collected on days 1, 15, 30, and 150, respectively. Hookworms were found in 13% of the stool samples on day 1 and in none of the samples on days 15, 30, and 150.

All treatments were easily administered and did not induce untoward behavioral or adverse reactions.

Several topical or systemic acaricidal compounds are used for the treatment of sarcoptic mange in dogs. Among those, lime sulfur and amitraz dips are widely used. The former is safe and effective, but it has an unpleasant odor and can stain jewelry and light-colored hair coats. The latter is an approved treatment for the condition in Canada but not the United States (1–3). In general, dips are recommended q7d (lime sulfur) or q14d (amitraz) for 4 to 6 wk. Clipping is recommended for dogs with long or dense coats to allow better skin contact with the acaricidal compound (1,2). Because this topical approach is labor intensive, especially when large numbers of dogs are involved, and because it is not

always effective or tolerated, therapeutic alternatives have been sought (4–6,10,11). Ivermectin and, more recently, milbemycin oxime (Interceptor, Ciba-Geigy, Greensboro, North Carolina, USA), both marketed as a once-a-month heartworm preventive, have been used as a systemic acaricide in canine scabies (4–6,10,11). These off-label uses of ivermectin and milbemycin oxime and offer effective therapeutic alternatives for dogs with scabies. However, milbemycin is expensive, and ivermectin, when administered SC, is inconvenient when large numbers of dogs are involved.

Ivermectin is used commercially for the broad-spectrum control of nematode and arthropod parasites in domestic animals (7–9). Table 1 summarizes various formulations of ivermectin that are currently registered for use in cattle, sheep, goats, pigs, horses, dogs, and humans. In dogs, ivermectin (Heartgard, Merck AGVET) is only licensed for the prevention of dirofilariasis at the dosage of 6 µg/kg BW, PO, once a month. Broad-spectrum activity (*Sarcoptes scabiei, Otodectes cynotis, Cheyletiella yasguri,* and gastrointestinal nematodes) can be obtained with extra-label dosage with ivermectin formulations marketed for other species (4–6); but ivermectin is not approved for those uses, because of possible idiosyncratic reactions in collies and possibly other breeds, such as, Australian shepherds, Old English sheepdogs, and Shetland sheepdogs or their crosses. Common signs of acute toxicity include ataxia, tremors, mydriasis, salivation, depression, and in severe cases, coma and death (4–7).

The preparation most commonly used extra-label in dogs for the treatment of endo- and ectoparasites is the injectable product for cattle, sheep, and swine (Table 1), a 1% nonaqueous solution comprising 60% propylene glycol: 40% glycerol formal (v/v). Although experimental reports have indicated that single, SC, doses of 200 µg/kg BW are effective for canine scabies, it is usually given PO or SC at the dose of 200 to 400 µg/kg BW every 14 d until the condition resolves (1–5).

A cutaneous (topical; pour-on) formulation of ivermectin was developed for catttle as a clear blue, alcohol-based, solution that is poured along the back of cattle to penetrate the skin and give systemic drug delivery. In order to achieve systemic concentrations sufficient to control gastrointestinal worms and lungworms, the dose (500 µg/kg BW) is higher than that of other formulations (200 µg/kg BW) in that species. As with the injectable formulation, the ivermectin persists *in vivo* long enough to provide a measure of prophylaxis against incoming nematode larvae (7–9). Pharmacokinetic data for this pour-on product have been compared with those of the oral product in goats (12). Caprine percutaneous administration of ivermectin at 500 µg/kg BW produced a lower peak concentration in plasma some 36 h later than did oral dosing at 200 µg/kg BW. Although the persistance of the drug in plasma was prolonged after percutaneous administration, the systemic availability of ivermectin was significantly lower than after oral administration (12). In goats, the area under the plasma concentration-time curve (AUC) was significantly larger after oral administration at the dose of 200 µg/kg BW than after topical administration at 500 µg/kg BW, even though plasma clearance was faster after oral administration (12).

The half-life and the peak plasma concentration of the pour-on formulation and the formulation administered PO or SC are not known in dogs. The pharmacokinetics of the various ivermectin formulations and various routes of administration in this species require further investigation. The present study was done to evaluate the therapeutic potential of the pour-on formulation in the treatment of scabies in dogs. Because of the apparent success obtained in our dogs, we can assume that there is a reasonable degree of systemic absorption and/or cutaneous dispersion, and we should therefore assume, until proven otherwise, that the systemic concentration obtained with the pour-on is sufficient to induce idiosyncratic reaction in susceptible dogs. We should, therefore, use the same precautions as when using off-label ivermectin SC or PO in dogs.

The dose and frequency of administration of the pour-on ivermectin used in the present study appeared effective in the treatment of canine scabies, and was sufficient to eradicate the mites from dogs in the shelter. Although a single SC administration of ivermectin has been effective against sarcoptic mange in dogs (5), 2 applications were used in the present study. However, further studies should be conducted to evaluate if a single application is sufficient to eradicate scabies infestation.

The design of the study (the setting of the shelter) precluded the evaluation of the effectiveness of pour-on ivermectin against gastrointestinal nematodes. Indeed, because new dogs were introduced to the shelter at 1 time or another during the 150 d of the trial, and since stool samples were collected at random from different pens, it was impossible to be sure that the samples came from dogs treated on day 1 and 15 with the pour-on ivermectin. Nevertheless, the results from flotations performed through the study revealed a progressive decrease in the number of positive fecal samples. Therefore, these findings should encourage further studies to evaluate the efficacy of the pour-on ivermectin in the treatment of intestinal nematodes in dogs.

The cost of the treatment regimen reported here is equivalent to the cost of injectable ivermectin administered twice at the dose of 200 µg/kg BW, SC or PO. It is easily administered and does not require the use of a sterile needle for each dog or induce pain at the site of injection. Therefore, it provides a very practical and well tolerated alternative to administration of the injectable compound PO or SC and is much less labor intensive than acaricidal dips, which require clipping of long or dense pelage prior to application. CVJ

References

1. Scott DW, Miller WH Jr, Griffin CE. Muller and Kirk's Small Animal Dermatology, 5th ed. Philadelphia: WB Saunders, 1995: 417–432.
2. Griffin CE. Scabies. In: Griffin CE, Kwochka KW, MacDonald JM, eds. Current Veterinary Dermatology: The Art and Science of Therapy. St-Louis, Missouri: Mosby Year Book, 1993: 90–95.
3. Moriello KA. Treatment of *Sarcoptes* and *Cheyletiella* infestations. In: Kirk RW, Bonagura JD, eds. Kirk's Current Veterinary Therapy XI, Small Animal Practice. Philadelphia: WB Saunders, 1992: 558–560.
4. Paradis M. Ivermectin in small animal dermatology. In: Kirk RW, ed. Current Veterinary Therapy X, Small Animal Practice. Philadelphia: WB Saunders, 1989: 560–563.

5. Yazwinski TA, Pote L, Tilley W, Rodrigues C, Greenway T. Efficacy of ivermectin against *Sarcoptes scabiei* and *Otodectes cynotis* infestations in dogs. Vet Med Small Anim Clin 1981; 76: 1749–1751.
6. Scheidt VJ, Medleau L, Seward RL, Schwartzman RM. An evaluation of ivermectin in the treatment of sarcoptic mange in dogs. Am J Vet Res 1984; 45: 1201–1204.
7. Campbell WC. Ivermectin, an antiparastic agent. Med Res Rev 1993; 13: 61–79.
8. Marley SE, Hall RD, Corwin RM. Ivermectin cattle pour-on: Duration of a single late spring treatment against horn flies, *Haematobia irritans* (L.) (Diptera: Muscidae) in Missouri, USA. Vet Parasitol 1993; 51: 167–172.
9. Soll MD, d'Assonville JA, Smith CJZ. Efficacy of topically applied ivermectin against sarcoptic mange (*Sarcoptes scabiei* var. *bovis*) of cattle. Parasitol Res 1992; 78: 120–122.
10. De Jaham C, Henry CJ. Treatment of canine sarcoptic mange using milbemycin oxime. Can Vet J 1995; 36: 42–43.
11. Miller WH Jr, de Jaham C, Scott DW, Cayatte SM. Treatment of canine scabies with milbemycin oxime. Can Vet J 1996; 37: 219–221.
12. Scott EW, Kinabo LD, McKellar QA. Pharmacokinetics of ivermectin after oral or percutaneous administration to adult milking goats. J Vet Pharmacol Ther 1990; 13: 432–435.

BOOK REVIEW

COMPTE RENDU DE LIVRE

Fowler ME. ***Wildlife Husbandry and Diseases, vol. 15, no. 1.*** Office International des Epizooties, Paris, France, 1996. 368 pp. ISBN 92-9044-400-2. $54.00 US.

This softcover book, coordinated by Dr. Murray Fowler, focuses on the effect of husbandry practices on infectious and parasitic diseases of wild animals maintained in captivity. Eighteen chapters, by single or multiple authors, represent a broad range of international experience in working with aviculture, wildlife rehabilitation, game ranching, and zoo animal medicine. Most of the chapters are written in English, with summaries in French and Spanish.

Dr. J. Blancou, director general of the Office International des Epizooties, summarizes the objectives of the book:

1) to consider the husbandry practices currently employed for care of captive wild animals in various parts of the world;
2) to consider how these husbandry practices either inhibit or favour the occurrence of infectious or parasitic diseases in the captive environment;
3) to describe some of the more important diseases of captive wild animals;
4) to highlight diseases that have zoonotic potential; and
5) to discuss epizootic implications of diseases which may be shared between domestic and free-ranging wild animals.

Disease surveillance, zoonotic potential, and the importance of quarantine procedures are emphasized. Some chapters are necessarily broad in coverage, with significant diseases of an animal group included in tables listing etiology, susceptible species, and clinical signs or transmission. However, veterinarians who work with ratites, carnivores, swine, camelids, bison, and cervids will find more detailed information for practical reference to the significant diseases, including diagnosis, prophylaxis, and vaccination recommendations where appropriate.

Tuberculosis in deer, a topic of considerable regulatory interest in recent years, receives in-depth coverage, including a historical perspective of tuberculosis in humans and livestock; the recent development of commercial deer farming; the increasing frequency of international shipment of deer; and the concerns for the potential spread of tuberculosis to wildlife. Accuracy of diagnosis of tuberculosis can be improved by combining the results of intradermal skin testing with the blood tuberculosis test (BTB), which incorporates 3 tests (lymphocyte transformation, ELISA, and measurement of inflammatory cofactors) performed on a blood sample from a suspected case.

A chapter on management protocols for animals in captive propagation and reintroduction programs will be of interest to veterinarians and students who are not regularly working in this field, as an introduction to the special considerations of environmental assessments and disease surveillance, and to the complex relationships of institutions, specialty groups, and government agencies that work together to develop successful propagation and reintroduction programs. A separate chapter considers the use of serological tests to facilitate management decisions with regard to animal translocations, and warns of the problems that may be encountered in the direct extrapolation of diagnostic tests used in domestic livestock species to free-ranging and captive wildlife species.

The spectrum of information included in this book is not readily available in other texts. The lack of an index is a definite weakness for those who may wish to review the incidence of a particular disease across taxonomic divisions. However, chapters are succinct and well organized, and information for a particular animal group or management protocol should be easily accessed by referring to the table of contents.

Reviewed by ***Kay G. Mehren, DVM, Dipl. ACZM,*** *Metropolitan Toronto Zoo, 361A Old Finch Avenue, Scarborough, Ontario M1B 5K7.*